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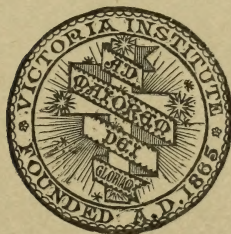
JOURNAL OF
THE TRANSACTIONS
OF
THE VICTORIA INSTITUTE,
OR,
Philosophical Society of Great Britain.

EDITED BY THE HONORARY SECRETARY,
CAPTAIN F. W. H. PETRIE, F.G.S., &c.

No. 105,

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** * * The Institute's object being to investigate, it must not be held to endorse
the various views expressed at its meetings.*

JOURNAL OF THE TRANSACTIONS

OF THE

VICTORIA INSTITUTE,

OR

PHILOSOPHICAL SOCIETY OF GREAT BRITAIN.



ANNUAL GENERAL MEETING,

HELD AT THE HOUSE OF THE SOCIETY OF ARTS,
MONDAY, AUGUST 1, 1892.

Sir JOSEPH FAYRER, M.D., K.C.S.I., F.R.S., *Vice-President.*

IN THE CHAIR.

Captain FRANCIS PETRIE, F.G.S., &c., Hon. Sec., read the following Report :—

Progress of the Institute.

In presenting the TWENTY-SIXTH ANNUAL REPORT, the Council is able to record the continued steady progress of the Institute both at home and abroad; this a subject for special congratulation, considering the severe losses the Institute has sustained in the extraordinary number of deaths among its active Members,* as well as those adverse influences which have affected every class and interest, not only at home but in several of the colonies.

The increasing interest taken in the Institute's welfare both

* 103 during the influenza epidemic.

by its supporters and the public generally, and the many former Members who have this year rejoined its ranks, have tended to strengthen the hands of the Council in conducting its work. In this they have been further encouraged by the munificence of one of the Members, his Excellency Dr. R. H. Gunning, who has presented the Institute with a sum of £500, under the following conditions:—

“The interest or income thereof to be held in trust always, for the purpose of endowing a prize, to be awarded triennially, in recognition of services rendered to the object of the said Society.”

Last summer and autumn meetings of the Council were held to consider the importance of securing an increased active interest in the Institute, especially among the leaders of thought in the Universities; and also to consult as to the most desirable and useful subjects to be taken up during the coming Session, so as more fully to carry out the great objects which the Institute was founded to accomplish. The beneficial results of these special meetings has been evidenced during the present Session, which has been one of the most successful.

Arrangements have also been perfected for enabling country, colonial, and foreign Members and Associates to take a part in considering the subjects brought before the Institute: all those interested in the various subjects can now, by intimating their wish beforehand, receive proof copies of the papers to be read, and can send in any comments they may see fit; these comments are brought before the Council with a view to being included in the discussion, which is published after each paper in the Journal. The value of the Journal is thereby enhanced to all, and made to include much that has not been brought before those attending the meetings.

The Library of Reference is becoming larger; but a Library Fund is desirable, in order to secure certain valuable books of reference which are constantly needed.

The following is the new list of the President and Council:—

President.

Sir George Gabriel Stokes, Bart., LL.D., Sc.D.,
Past President of the Royal Society.

Vice-Presidents.

The Rt. Hon. Lord Halsbury, Lord High Chancellor.
 Sir H. Barkly, G.C.M.G., K.C.B., F.R.S.
 Sir Joseph Fayrer, K.C.S.I., F.R.S.
 W. Forsyth, Esq., Q.C., LL.D.
 Alexander McArthur, Esq., M.P.
 Rev. Preb. Robinson Thornton, D.D.
 W. H. Hudleston, Esq., M.A., F.R.S., *President of the Geological Society.*

Trustees.

D. Howard, Esq., D.L., F.C.S.
 Rev. Preb. H. Wace, D.D.
 W. N. West, Esq., F.R.G.S., F.R.Hist.Soc.

Hon. Auditors—J. Allen, Esq.; J. E. Wakefield, Esq.

Council.

Hon. Treas.—W. N. West, Esq., F.R.G.S., F.R.Hist.S.
 Hon. Sec.—Capt. F. W. H. Petrie, F.G.S., &c.

- | | |
|---|--|
| *E. J. Morshead, Esq., F.M.C.S. (<i>For. Cor.</i>). | His Excellency Dr. R. H. Gunning, F.R.S.E. |
| William Vanner, Esq., F.R.M.S. | *Rev. Preb. H. Wace, D.D. |
| S. D. Waddy, Esq., Q.C., M.P. | Rev. J. J. Lias, M.A. |
| Rev. Principal Rigg, D.D. | *Gen. G. S. Halowes (<i>Cor. Sec.</i>). |
| H. Cadman Jones, Esq., M.A. | Rev. A. I. McCaul, M.A. |
| Rev. W. Arthur. | Capt. Creak, R.N., F.R.S., &c. |
| Rev. Principal J. Angus, M.A., D.D. | Rev. F. A. Walker, D.D., F.L.S. |
| J. Bateman, Esq., F.R.S., F.L.S. | T. Chaplin, Esq., M.D. |
| *D. Howard, Esq., D.L., F.C.S. | Admiral H. D. Grant, C.B. |
| Professor H. A. Nicholson, M.D., F.R.S.E. | Rev. Canon Girdlestone, M.A. |
| Bisser Hawkins, Esq., M.D., F.R.S. | Professor E. Hull, LL.D., F.R.S. |
| The Bishop of Wakefield. | Lt.-Col. Freeman, M.A. |
| Rev. F. W. Tremlett, D.C.L. | Sir G. Buchanan, M.D., F.R.S. |
| Surg.-Gen. Gordon, M.D., C.B. Q.H.P. | |

* *Ex officio.*

The Council regret to announce the decease of the following supporters of the Institute:—

Sir W. Bowman, M.D., F.R.S., *A.*; Rev. Canon W. Carus, M.A., *M.*; Rev. J. Cohen, M.A., *A.*; Sir John Coode, K.C.M.G., *M.*; Sir J. Porter Corry, Bart., M.P., *A.*; E. Crewdson, Esq., *A.*; Rev. President Darling, D.D., *A.*; Rt. Hon. W. W. L., Earl of Dartmouth, *M.*; Rev. J. Donaldson, *A.*; Rev. H. S. Eckersley, *A.*; Rev. C. J. Garrard, *A.*; Surgeon-General J. Goodall, M.R.C.S.E., *M.*; Rev. C. J. Goodhart, M.A., *A.*; W. J. Gunning, Esq., *A.*; G. C. Harrison, Esq., *F.L.M.*; J. Thornhill Harrison, Esq., *M.*; Rev. D. Honeyman, D.C.L., F.R.S.E., *A.*; Rev. J. Hudson, M.A., *A.*; Gen. C. W. Hutchinson, R.E., *A.*; Rev. E. P. Ingersoll, *A.*; D. Mackintosh, Esq. (*cor. mem.*); the Rt. Rev. Bishop Philpott, D.D., *A.*; Rev. T. Robinson, D.D., *A.*; Rev. President T. E. Rooke, D.D., *M.*; Rev. W. Sathianadain, D.D., *A.*; H. J. Sanderson, Esq., M.D., *A.*; Rev. E. H. Smart, *A.*; W. J. Smellie, Esq., *A.*; W. Castle Smith, Esq., *F.L.M.*; J. Staikartt, Esq., *F.M.*; Rt. Rev. M. Thomas, D.D., Bishop of Goulburn, *A.*; Rev. G. Turner, LL.D.; Mrs. Voile, *A.*; C. S. Wilkinson, Esq., F.G.S., Pres. Rl. Soc., N.S.W., *M.*; Rev. B. C. Young, *A.*

F. Foundation *M.* Member. *A.* Associate. *L.* Life.

The following is a statement of the changes which have occurred :—

	Life		Annual	
	Members.	Associates.	Members.	Associates.
Numbers on June 19, 1891	.... 59	43	365	804
Deduct Deaths	.... —	—	10	25
„ Retirements, changes, &c.	—	—	3	11
	59	43	— 13	— 36
			<u>352</u>	<u>768</u>
Joined to June 20, 1892....	.... 4	1	18	67
	<u>63</u>	<u>44</u>	<u>370</u>	<u>835</u>
	} 107		} 1205	
Total	....	....	1311	
Hon. Correspondents number	124.	Total	....	1435.

Finance.

The Treasurer's Balance-sheet for the year ending December 31, 1891, duly audited, shows a balance credit of £233 10s. 5d., after the payment of all liabilities, with the exception of one printer's bill, since received, of £170 6s. The amount invested in 2½ per Cent. Consols is £1,365 18s. 9d.

The Council desires to urge the great advantage it would be were Members to remit their Subscriptions during the first half of the year, as a large proportion already do. Were this the rule with all, the whole machinery of the Institute would work with an ease that would greatly add to its success. Forms for the payment of the Subscriptions through a banker are used by a large number, and may always be had.

The arrears of subscriptions are as follow :—

	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
Members	.... 3	3	11	0	1	3	0	6	10
Associates	.... 7	1	3	7	10	15	6	5	15
	<u>10</u>	<u>4</u>	<u>14</u>	<u>7</u>	<u>11</u>	<u>18</u>	<u>6</u>	<u>11</u>	<u>25</u>

MEETINGS.

MONDAY, DECEMBER 7, 1891.—“Islâm: its origin, its strength, and its weakness.” By Rev. W. ST. CLAIR TISDALL, M.A.

MONDAY, JANUARY 4, 1892.—“From Reflex Action to Volition.” By Dr. ALEX. HILL, Master of Downing Coll., Cambridge. With remarks by SIR JOSEPH FAYRER, K.C.S.I., F.R.S., and others.

- MONDAY, JANUARY 18.—(*Paper postponed by reason of the death of H.R.H. The Duke of Clarence and Avondale.*)
- MONDAY, FEBRUARY 1.—“The weak side of Natural Selection.” By J. W. SLATER, F.C.S., F.E.S. “A Brief Note on the effects of a recent Submarine Volcano.” By Colonel MACKOWEN and Captain F. PETRIE, F.G.S.
- MONDAY, FEBRUARY 15.—“Miracles and Science.” By Rev. J. J. LIAS, M.A.
- MONDAY, MARCH 7.—“Serpent Worship and the Venomous Snakes of India.” By Sir JOSEPH FAYRER, K.C.S.I., M.D., F.R.S.
- MONDAY, MARCH 21.—“Traditions and Traces of Eden in Heathen Mythology.” By J. S. PHENÉ, LL.D.
- MONDAY, APRIL 4.—“On the Philosophical Value of the Argument from Design.” By Professor J. H. BERNARD, D.D., of Trinity College, Dublin.
- MONDAY, APRIL 11.—(*Instead of 18th—Easter Monday.*)—“On the Glacial Period and the Earth-movement Hypothesis.” By Professor JAMES GEIKIE, LL.D., D.C.L., F.R.S., &c.
- MONDAY, MAY 2.—“On the Past and Present Water Supply of Jerusalem and of Palestine.” By Colonel Sir CHARLES WILSON, R.E., K.C.B. K.C.M.G., D.C.L., LL.D., F.R.S.
- MONDAY, MAY 16.—“On Primitive Man.” By Rev. J. MAGENS MELLO, M.A., with a supplementary Paper by Sir J. WILLIAM DAWSON, C.M.G., F.R.S., &c.
- MONDAY, JUNE 20.—“On the Reality of Knowledge.” By JOSEPH JOHN MURPHY, Esq.—A Note on some results of Egyptian Exploration during the past season. By Count RIAMO DE HULST.
- MONDAY, AUGUST 1.—*Annual Meeting at the House of the Society of Arts.*—Address by The Right Honourable LORD HALSBURY, Lord High Chancellor.

So successful a Session as the present has probably not been held during any year since the Institute was founded. The meetings have been specially well attended. The improvements carried out by the Council in the introduction of the electric light and the abolition of the use of gas in the lecture room have added to the comfort of the Members.

Publications.

The Twenty-Fifth Volume of the Transactions is now about to be published; there has been a slight delay in its issue on account of the illness of some whose writings it includes. It contains, among other important papers, one of much research on *Islâm*, in the discussion of which many who had long studied the subject took part. This paper will probably be found as generally useful as the one on Buddhism which attracted so much attention.

Not many years ago the issue of the Annual Volume was considered to complete the work of the Institute, but of late

the wish to make further use of the valuable matter it contains has resulted in the following operations which the Council has sought to encourage, and hopes to see more generally adopted.

First—Members and Associates, at home, in India, North and South America, Australasia, and elsewhere, make use of the papers in the Journal as Lectures, or as the basis of such, in their several localities (often corresponding with the Institute in regard to the preparation of such lectures): excellent results have followed the adoption of this system.

Secondly—Many Members and Associates secure the translation and circulation of portions of the Journal in the various countries in which they are resident. Such translations have been made in many countries of Europe, South America, and India; and now from China the importance of securing translations has been strongly urged.

Thirdly—Many home, foreign, and colonial public libraries and institutions are regular purchasers of the Journal, and Members and Associates have sought to encourage this practice in their respective localities. The need of so doing has been pointed out by many, since it is by no means unusual, especially in the Colonies, to find in public libraries books arguing that Science and Revelation are at variance. The Journal of the Institute has been spoken of as specially suited as a corrective to such erroneous views.

The Special Fund.

This fund has been founded to advance the influence of the Institute, and to forward the circulation of

THE PEOPLE'S EDITION:—This consists of twelve papers—written by men of eminence in such a style that they may be comprehended by all—reprinted from *the Journal of Transactions*. The edition was started by some Members in the year 1873, and first attracted attention in other quarters to the importance and need of works of the kind. The pamphlets often contain the objections and criticisms brought forward in discussing the subjects, as many home and foreign correspondents have urged the value of including these. They are published in neat covers, and are sold at a nominal price (sixpence) by the Institute's organisation of bookseller agents, and single copies are supplied *gratuitously* or at cost price, at the office, to all individual lecturers against infidelity,

including those of the London City Mission, the Christian Evidence Society, and similar bodies.

Conclusion.

All must feel thankful for the Institute's progress hitherto. Its high objects and the manner in which these are sought to be carried out, have earned it extensive support in most parts of the world. But it has become necessary that such a Society, with so widely-spread a constituency, should be stronger in numbers, both at home and abroad. Were each Member and Associate to seek to gain additional adherents in his own locality, not only would the Institute's power for usefulness be increased, but the extent of that usefulness would be more widely felt. No higher incentive could be found to impel to so needed a work than that expressed in the words of its motto.

G. G. STOKES,

President.

SPECIAL FUND IN 1892.

People's Edition.

	£	s.	d.
Harries, G., Esq.	20	0	0
Hawkins, Bisset, Esq., M.D., F.R.S.	5	0	0
Dent, H. C., Esq., C.E., F.L.S.	1	1	0
Harrison, Miss Grace	0	10	0
	<hr/>		
	£26	11	0
	<hr/>		

The following Balance Sheet was then read:—

[The HONORARY SECRETARY (Captain FRANCIS PETRIE, F.G.S.) in reading the Report specially called attention to the presentation of £500 to the Institute by one of the members of the Council, His Excellency Dr. Gunning, who desired that the interest of this sum should be devoted to furthering the Institute's work; to the improved arrangements for enabling colonial and foreign members to contribute papers or take part in considering the subjects brought forward; to the increased disposition that was manifested by members residing abroad to translate and publish the Institute's papers and discussions for the benefit of those in their neighbourhood, and quoted the remarks made at the last Annual Meeting by the Archdeacon of Mid-China in regard to such work. He concluded by referring to the loss of 103 members by death, during the late epidemic, a loss involving only too many of the Institute's most valued and loyal adherents, whose places could best be filled by existing members introducing new supporters.]

The CHAIRMAN.—I have been called upon to take the Chair in the unavoidable absence of the President, who greatly regrets that a prior engagement has deprived him of the pleasure of presiding at our Annual Meeting.

Before the first resolution is moved I wish to say one or two words. I am quite sure that you have all listened with satisfaction and with pleasure to the Report that has been read. It is very gratifying to find that in spite of the heavy mortality among its members during the late epidemic the progress of the Victoria Institute is so satisfactory, that its sphere of influence is widening and extending into different quarters of the globe, and that its proceedings have given pleasure and instruction to a large number of people.

It seems to me that the purpose for which this Institute was founded is one at which scarcely anyone could cavil. It is quite true that a very large number of educated people of the present day admit that there can be no conflict between Science and Revelation properly understood, but there are an enormous number of persons who are not in that happy position. There are people, for instance, who confound dogmatic theology with religion, and who do not appreciate what science really is. There are those who are neither capable of understanding the one nor of comprehending the other, and so I presume those mistakes and those inaccuracies which have always existed, still exist, and will continue to exist;

but it is the aim and object of this Society to endeavour to do away with these defects. This Institute is not antagonistic to science—if it were I should not remain in it for an hour—and the very fact that so many of its members are men of science, and that our President is a leading man of science, is sufficient to prove this. It has no prejudices, but it seeks to know the truth, the real truth; and it has no desire to place itself in conflict with religious thought. Its aim is to remove those difficulties which still exist among so many, for Science and Religion cannot really be in conflict if they be studied in a proper spirit; but if there be dogmatic assertions on the one side and self-sufficiency and obstinacy on the other, it is quite impossible that they can ever be held in accord. To bring about a right understanding is one of the aims of this Society, and I am very glad to find that its work has been so satisfactory, and that many Papers in the Transactions that have gone abroad have been translated into foreign languages. Our work has done much good, and I think every one must wish well to the Victoria Institute, and desire that its progress may continue to be as gratifying as in the past. I will now call on Sir Henry Barkly to move the adoption of the Report.

Sir H. BARKLY, K.C.B., G.C.M.G., F.R.S.—Sir Joseph Fayrer, my lord, ladies and gentlemen: I rise to move the adoption of the Report, but as you have heard its contents already sufficiently in detail, I will not detain you by making further allusion to it, as I am sure you will agree with me that all concerned in the production of so satisfactory a Report, are entitled to your thanks. I will therefore move, without further preface,—“That the Report be received, and the thanks of the Members and Associates presented to the Council, Honorary Officers, and Auditors for their efficient conduct of the business of the Victoria Institute during the year.”

Professor HULL, LL.D., F.R.S.—I have great satisfaction in being permitted to second the adoption of the resolution which has been moved by Sir Henry Barkly. I think, however, we should be wanting in our duty if we did not say a little more in reference to the services of the Honorary Officers of this Institute. I will therefore say, in the first place, how greatly the Institute is indebted for its present position and usefulness to our President, Sir George Gabriel Stokes, because I know he takes a very great interest in its progress and work, and that he has been here to take part in

the deliberations of the Council and to preside at the meetings on occasions when other public duties have had their claims upon him; and I think any one who knows the work of this Institute will agree with me that we are also indebted to the labours of our Hon. Secretary—(applause)—Captain Petrie. We owe him a debt of gratitude not only for the time and energy he has given to the Institute, but for the manner in which he has carried out the Council's wishes, his unfailing urbanity, his strict attention to the duties and *minutiae* of the work, which occupies his whole time, and I happen to know by accident that sometimes when we are comfortably resting in our beds he is at work at the desk carrying on the correspondence. Therefore I think we should be doing violence to our feelings if the resolution did not contain the names of our President and Hon. Secretary (applause). The resolution was passed.

The Ven. Archdeacon THORNTON, D.D.—I am afraid I cannot claim to be anything more than a Member of the Council and a Vice-President, at the same time I am quite open to express the thankfulness of the Officers and Council and all connected with this Institute for the confidence that is reposed in them. The Council have always endeavoured and will always endeavour, I am sure, to keep in mind the motto of the Society. The motto of the Society is this—not printed or impressed upon a seal, but the motto that regulates its proceedings—that between Scripture rightly interpreted and the facts of science rightly understood and deductions rightly drawn, there cannot possibly be any conflict, and that wherever there is any apparent conflict it must be the consequence of misinterpretation of Scripture or of scientific facts. There is another Society which deals rather with the interpretation of Scripture but this Institute has nothing to do with the interpretation of Scripture or dogmatic suggestions; the line it takes is to examine scientifically, including history, the scientific and technical objections brought against the Book which we revere, and that Book is always kept in mind, and always will be—so we hope to be the means of clearing away many of the difficulties that have interfered with people's acceptance of Scripture; and likewise, we steer clear of religious controversy. I am quite sure that this has always been our aim and desire, and we shall be encouraged in this work by the vote of thanks that has been so kindly accorded to us to-day, and I beg to return thanks for it.

The HON. SECRETARY (Captain PETRIE, F.G.S.).—Sir Joseph Fayrer, my Lord, ladies and gentlemen: In thanking Professor Hull for the very kind remarks that he has made in regard to myself, I feel they are more than I deserve; it is to the Council that so much is due. As one of the earliest of the founders of the Institute I can say this—that with such a Council it would be perfectly easy for anybody to conduct the affairs of this Institute.

The Right Honourable LORD HALSBURY, LORD HIGH CHANCELLOR (Vice-President), then delivered the following ADDRESS:—

A DISTINGUISHED President of this Society once said that to gauge thoroughly the amount of evidence on which an asserted scientific conclusion rests, one ought to be well acquainted with the branch of science to which it relates, but that still one might get a fair general notion of the evidence by an amount of reading by no means prohibitive or by conversing with those who have made that branch a special study.

I should think the Council of this Institute must have been moved by some such reflection in requesting me to deliver the Annual Address. I certainly am not entitled to mount the platform as a teacher but rather as the average auditor and student to say something of our work and our methods.

Not altogether unfamiliar with the process of considering the weight of evidence, and taught by some experience to listen to both sides, I may, perhaps, be qualified to give an opinion on the value of a particular argument, though I do not of course pretend to have formed no opinion upon the great question, the investigation and support of which forms, I believe, the charter of this Institute.

According to our methods the investigation must be both thorough and independent. Other avocations have hitherto prevented me from taking much part in the discussions myself, but I have had the advantage of reading what wise and learned men have written and said upon the various subjects which have been brought under review, and I observe that they have been thoroughly dissected, argued, and freely discussed. It is one of the supreme advantages

of such a method that no refuge can be found for confused thought, in words of learned length or what, perhaps, I may call the slang of the Schools. The critic is present and ready for the fray, and hesitates not to probe the dark speech to the bottom, and at all events, to get at what is intended to be conveyed by words however long and by circumlocution however intricate.

Such a word, for instance, as *supernatural* has not been suffered to escape searching scrutiny, and it has been justly asked how, until Nature has been forced to disclose all that is comprehended in the natural world, the word supernatural can have any real meaning.

That words are the counters of wise men and the money of fools is a terse if not a very accurate apothegm, representing, however, a very important truth, I mean not very accurate in its assumed antithesis, since it treats money as of a value intrinsically apart from what it represents, but adopting for the sake of the truth involved the economic error of the illustration, it will lead one to weigh the words which are in vogue in the philosophical discussions of our time and see whether we have a new thing or a new word.

Now it has lately become the fashion to deal with every subject and with every aspect of every subject as though nothing were absolutely true or absolutely false, a system whereby definite and accurate thought is repudiated, and every error, however monstrous, every dreamy imagination treated not as a blunder, but in the pseudo-philosophic slang *subjectively* true. It is said that mental phenomena are not the less real because the subject of the conceptions have no real representatives in the external world, and this is true if it means no more than that the blunderer believes in his blunder.

As long as such words as subjective and objective are recognised as the x and y of an algebraic problem, and to have no meaning in themselves, they may be accepted as convenient words for the purpose for which the calculator designs them, but unfortunately their use has become such as to mislead.

There *is* such a thing as truth and falsehood, irrespective of what people think or say.

There are diseases which create delusions, delusions let us say about colour and the victim of a malady sees everything yellow. Are the things yellow because he sees them thus?

The victim of delirium tremens sees frogs and toads and creeping things innumerable. Are there any there?

A man comes to the margin of a river and in the mist he thinks he sees a bridge.

To adopt the *patois* of fraud against which I am protesting, he plants, or strives to plant, his objective legs on his subjective bridge. He may well ask in the language of some of the boys' puzzles—where is the bridge?

Or take the still more homely illustration, you give a boy a sum to do—he does it wrong and, dropping philosophic language, he makes a blunder in his arithmetic. Suppose he answers his indignant tutor with the excuse that subjectively the wrong addition was to his mental conception subjectively true, would not the objective birch rod suggest totally different subjective conceptions? Now let us weigh some of our words.

That there are degrees of proof from demonstration to a slight balance of probability will not justify the phrase proved, and one is perpetually to be on guard against the allegation that a thing is proved because there is some evidence in favour of it. I will not proceed, though I might, with a whole catalogue of words which the modern sophist uses either in a double sense or with a meaning which involves as an assumption the thing to be proved.

Among many advantages, and they are many, which have been introduced by the facility with which printed matter may be circulated there is the corresponding disadvantage that error is circulated with as much facility as truth, and error is ignorance not knowledge. The great Roman poet denounced with bitter indignation the poetasters of his time who were degrading the literature of his country, and in our time we have the printing press which Juvenal had not.

Each period has of course its popular madness or popular folly, and at one time the torrent of trash which each age in turn produces in full measure is turned in different directions. Della Crusca poetry, however, has vanished, but *Lamarck-ins Darwin-ettes* abound in our time; public taste has taken a form which induces each publication to contribute its own little addition to the literature of unbelief, and if we hear nothing of the Grove of Mars or Vulcan's Cave we have "evolution" enough to swallow up all the tragedies and elegies which disturbed the Roman sage.

But side by side all this, with an incongruity which is not without example in the tide of human error, we have seen

in a proportionate degree the most marvellous credulity upon the subject of spiritual manifestations. Many who, if they do not reject absolutely, treat with a polite indifference the teachings of eternal truth, will, nevertheless, sit round a table and listen to the rappings or creakings with a half belief if not more in the inspired character of mahogany.

The Hebrew Prophet held up to scorn the ignorant idolater who from the same tree could cut a piece of wood and apply it to domestic use and of the rest make a God to worship, but the Table-turner improves upon his Hebrew original, he finds an oracle in the table from which he eats his dinner; it is true that the table has lately gone out of fashion, but have we not Mahatma and paper messages sent by no known mortal agency and manufactured by no known paper-maker?

Since the famous protest of 1865, to which hundreds of scientific and learned men, learned in every field of human thought, put their signatures, we have not heard so much of all scientific men having given up the Bible, but a great assumption to that effect is made to run through all that class of literature to which I have been referring.

Now this Institute sanctions discussion and enquiry not upon subjects strictly theological but on all subjects in respect of which knowledge can be obtained, and shirking none which might seem to touch the regions of religious belief.

In relation to such a belief history, language, physical metaphysical research—the records of the past, and the reasons which make it probable that there is a future for man beyond the passing shadow of human life. These subjects have been treated with courage and have been among those brought before your audiences; but the main usefulness of such discussions must be found in answering objections not as affording affirmative proof, while rejecting no region of enquiry which can throw light on any part of creation.

A story is told of Heraclitus, whose fame was so great that certain persons came to see so great a man. They came, and as it happened, found him warming himself in a kitchen. The meanness of the place occasioned them to stop, upon which the Philosopher accosted them: "Enter (said he) boldly for here, too, there are Gods."

Harris, in his *Hermes*, adds: "That as there is no part of nature too mean for the Divine presence, so there is no kind

of subject having its foundation in nature that is below the dignity of a philosophical inquiry."

Now our knowledge is necessarily derived through the instruments the Creator has given us—our hearing, sight, touch, are but instruments for conveying to "something somewhere" a consciousness of external objects. The memory, whatever it is, and wherever it resides, is but an instrument which stores up our previous conception, and that combination of faculties which we call the reason, and which does more than mere memory in bringing our minds to a conclusion, is but an instrument; each and all of these faculties in turn are liable to error, the lens may be defective and throw the rays of light at a wrong angle, and the nerves of hearing and touch may be insensible, and send no message at all to the inner consciousness, or may be so partially defective as to send one which is altogether erroneous. The reasoning faculty may be so completely out of order that even when there is no error in the memory of facts previously stored up, the true conclusion is not deduced. These are errors necessarily incident to the investigation of truth by creatures dependent on instruments for the aggregate of ascertained facts which we call knowledge, but what relation have the faculties of creatures so endowed with an eternal and omniscient and almighty Being who sees not by the eye, hears not by the ear, who from all eternity has been the same, to whom the past, present, and future are one and the same, these words only suggest relations of time to the children of the hour, but are unmeaning as applicable to one who is the same yesterday, to-day, and for ever, the great I AM, throughout that eternity which is part of His essential attribute as the Creator, the Everlasting God, and of whom one of old asked "canst thou by searching find out God?"

One is not very likely in these days to undervalue the services to knowledge in its widest sense of the researches of scientific men. One is indeed wonderstruck at the variety and width of those researches. It is absolutely bewildering to think of the silent but effective additions to knowledge which are being made from day to day by men who silently and often without reward, except the satisfaction which successful scientific research affords for its own sake, and which reveal to us unknown wonders in creation.

Major-General Dryson, for example, discovered in a region where all was supposed to be known, the Poles describing

two circles in their daily rotation. But here is a remark made by one no mean authority upon such a subject that the highest acquirement ever made by the most exalted genius of man has only been to trace a part and a very small part of that order which the Deity has established in His works.

When we endeavour to subject the Divine Revelation to our methods of physical research we are met at once by the obstacle that we are endeavouring to penetrate into a region to which our faculties are not appropriate. He who made the eye shall He not see? He who planted the ear shall He not hear? He who has given man his faculties to acquire a limited and narrowly circumscribed area of knowledge shall He be comprehended by the creature He has made in the vastness of His infinite perfection? It is no original observation that it is not given to us to comprehend all the order of the universe, and if we try to pry into the courses of that order we perceive the operation of powers which lie far beyond the reach of our limited faculties. Those who have made the furthest advances in true science will be the first to confess how limited those faculties are and how small a part we can comprehend of the ways of the Almighty Creator. They will be the first to acknowledge that the highest acquirement of human wisdom is to advance to that line which is its legitimate boundary, and there, contemplating the wondrous field which lies beyond it, to bend in humble adoration before a wisdom which it cannot fathom and a power which it cannot comprehend.

Professor Faraday, whose wisdom and learning as a student of natural science none will doubt, while distinguishing between faith the hope set before us, said in earthly matters he believed with St. Paul that the invisible things of Him from the creation of the World are clearly seen, being understood by the things that are made, even His Eternal Power and Godhead.

I have never seen, he adds, anything incompatible between those things of man which can be known by the Spirit of Man, which is within him, and those higher things concerning his future which he cannot know by that spirit alone.

It is only necessary to take even the heathen much more the Christian conception of the Deity to recognize the profane absurdity of attempting to measure, to analyse, or examine Divine attributes by human instruments. Let me take the heathen first.

It was a heathen philosopher who said, "So that when you have shut your doors and darkened your room remember never to say that you are alone, but God is within and your genius is within and what need have they of light to see what you are doing."

Lactantius attributes to Seneca almost the identical thought when he says that it is an admirable sentiment with which Seneca concludes his exhortation. "Withal God," says he, "is great, I know not what, an incomprehensible power. It is to Him that we live and to Him that we must approve ourselves; what does it avail us that our businesses are hidden from Men when our Souls lie open to God?"

Now let us have the Christian sage.

"I mean then," said one now taken to his rest, "by the Supreme Being, one who is self-dependent and the only Being who is such; moreover that He is without beginning or eternal; that in consequence He has lived a whole eternity by Himself, and hence that He is all-sufficient—sufficient for His own blessedness, and all-blessed, and ever blessed. Further, I mean a Being who, having these prerogatives, has the supreme good, or rather is the supreme good, or has all the attributes of good in infinite intensesness; all wisdom, all truth, all justice, all love, all holiness, all beautifulness; who is omnipotent, omniscient, omnipresent, ineffably one, absolutely perfect; and such that what we do not know, and cannot even imagine of Him is far more wonderful than what we do or can. I mean, moreover, that He created all things out of nothing, and preserves them every moment, and could destroy them as easily as He made them; and that in consequence He is separated from them by an abyss, and is incommunicable in all His attributes. And further, He has stamped upon all things in the hour of their creation their respective nature, and has given them their work and mission, and their length of days, greater or less, in their appointed place. I mean, too, that He is ever present with His works, one by one, and confronts everything He has made by His particular and most loving providence, and manifests Himself to each according to its needs, and has on rational beings imprinted the moral law, and given them power to obey it, imposing on them the duty of worship and service, searching and scanning them through and through with His omniscient eye, and putting before them a present trial and a judgment to come."

Equally in the heathen as in the Christian utterances we

see involved the eternity, the omniscience, the omnipresence of the Divine Being.

What relation has the scalpel or the microscope to such conceptions, or what experimental research is here applicable? Surely the very thought is as philosophically inappropriate as it is profane in its bare suggestion.

We have been boldly assured within the last year or two that we have all lost our faith.

I do not know what mandate Mr. Porter received, and who are supposed to be represented by "all," but I do not believe that it is true.

The Rock of that faith has received an assurance which will not let us doubt that that faith will long survive the cavils of each succeeding wave of unbelief.

Not for the first time in the history of Christendom heresies have for a time seemed to prevail.

A period of great intellectual activity will naturally give rise to many varieties of thought, the *nimia subtilitas* of some intellects may again, as they did in the earlier ages of the Church, refine very plain statement into meaningless mysticism, but now, as then, we may look for help where help may be found.

The darkness of one period may be but the precursor of a brighter dawn to succeed.

These oscillations will probably continue to the end.

Then, and not till then, will the darkness be dissipated, and when the true and everlasting light shall shine, we shall know even as we are known. Here and now we see, and can only see in a glass darkly or in a riddle, but then face to face.

Sir FREDERICK YOUNG, K.C.M.G.—Sir Joseph Fayrer, my Lord, ladies and gentlemen: A duty has been imposed upon me very unexpectedly, but still I accept it with the greatest possible pleasure. It is to move that a vote of “thanks be presented to the Lord High Chancellor (Lord Halsbury) for the Annual Address now delivered and to those who have read Papers during the Session.” I am sure I only interpret the feelings of every one present when I say that I have listened to that most beautiful and eloquent Address, which we have just heard with the most profound delight (applause). I think his Lordship has dealt with the subjects it contains in the most delightful and charming way, and we must all have felt the force of what he has so admirably put before us. (Applause.) I have the greatest possible pleasure in proposing the vote of thanks. (Applause.)

Sir G. BUCHANAN, M.D., F.R.S.—Sir Joseph Fayrer, my Lord, ladies and gentlemen: It is my privilege to second the resolution that has been submitted to you; I have very little to add to what has been said except to remark that if there is anything remaining in the way of a survival of that hostility between science and religion of which we have heard—a hostility that existed when people did not understand what religion and what science were—the proceedings of this Society during the past Session have done very much indeed to remove it, and certainly I need scarce say that our concluding meeting has helped to bring about a clearer idea of what the relations of science and religion are, and how they necessarily converge towards the one element—truth. I beg to second this resolution.

The CHAIRMAN.—It has been moved and seconded that a cordial vote of thanks be given to the Lord High Chancellor for his most philosophic, interesting, and valuable Address. I think I need hardly ask whether I have your permission to convey that vote of thanks. [The vote was carried by acclamation.]

LORD HALSBURY (the LORD HIGH CHANCELLOR).—I am most heartily obliged to you for your vote of thanks. (Applause.)

General R. F. COPLAND-CRAWFORD, R.A., F.G.S., F.R.G.S.—Sir Joseph Fayrer, my Lord, ladies and gentlemen: I have great pleasure in proposing a vote of thanks to our Chairman, Sir Joseph Fayrer. He is one who is distinguished in the annals of the history of India. He has brought scientific research to bear on the most beneficent desire for the promotion of the happiness

and culture of its people, and he has come back to give to us in the West the benefit of his experience in the East, and we are glad to have him presiding at this meeting, where we are honoured by the presence of the Lord Chancellor, who has given us such an Address—so happily delivered. (Applause.) I have only one word more to say. As an original founder of this Institute, I miss a great number of those who were connected with it. I have most pleasing and doubly interesting recollections of and associations with them; but I am thankful that there is left to us one to whom reference has been so rightly and so generously made—I refer to Captain Petrie. (Applause.) I recollect the heart he threw into our work and the way in which he devoted himself to it from the very commencement.

I beg to move “a vote of thanks to Sir Joseph Fayrer for presiding on this occasion,” and I am sure you will all agree with me that his services, both in the past and this day, entitle him to our grateful thanks.

Surgeon-General C. A. GORDON, C.B.—I beg to second, with all my heart, the vote of thanks which has been proposed by General Crawford. I am sure you will all agree with me that the pertinent and vigorous remarks of Sir Joseph Fayrer, leading up as they did to the excellent Address just delivered, were exceedingly valuable. We are all indebted to him not only for his most warm and sympathetic feeling in regard to the work of this Institute, but for having come home from India to give us the benefit of his presence and knowledge in England. [The vote was unanimously accorded.]

The CHAIRMAN.—My Lord Chancellor, ladies and gentlemen: I suppose a gift that comes quite unexpectedly is not the less acceptable on that account—indeed, perhaps it is more so. I had no more conception when I called upon the gallant General to speak, that he was going to allude to me than I had of any other improbable or impossible thing that could or could not happen. I thought this motion had reference to the President of the Institute, in whose absence I am promoted for the time being to the dignity of President; but still it is very gratifying to me in that it has evoked the kindly feeling of so many. Of the distinguished General we are all very proud, and I am very much gratified by the manner in which the resolution has been moved and seconded. I am much obliged to you for giving me your thanks, but I feel

that all our thanks are due to the learned Lord Chancellor. I never listened to anything with greater pleasure or gratification, and I sincerely hope that every word of the Address will appear in the Proceedings of the Society, so that thousands of others may learn and profit by it as we have done. (Applause.)

[The Members, Associates, and their guests then adjourned to the Museum, where refreshments were served.]

ORDINARY MEETING.*

PROF. E. HULL, LL.D., F.R.S., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following elections were announced :—

MEMBERS :—The Rt. Rev. A. Clifford, D.D., Bishop Designate of Lucknow ; C. F. Dowsett, Esq., London ; R. H. Fremlin, Esq., Kent.

LIFE ASSOCIATES :—W. Bodkin, Esq., M.D., Essex ; Rev. G. H. Butt, B.A., Camb., Lincolnshire.

ASSOCIATES :—The Rt. Rev. the Bishop of Down and Connor, Ireland ; General the Rt. Hon. Sir John Clayton Cowell, P.C., K.C.B., Master of the Queen's Household ; the Rev. T. S. Bacon, D.D., United States ; H. W. Bush, Esq., Kent ; the Rev. C. D. Bradlee, D.D., Ph.D., United States ; Major-General A. W. Drayson, F.R.A.S., &c., Hants ; C. H. S. Davis, Esq., M.D., Ph.D., United States ; R. M. Eyton, Salop ; Major H. J. Elverson, 2nd Queen's Regiment ; A. H. Harris, Esq., China ; Principal A. H. Hildesley, M.A., Punjab, India ; Rev. J. Moulson, M.A., Oxon, Punjab, India ; Rev. F. G. Le P. McClintock, A.B., Ireland ; A. Mueller, Esq., M.D., Ch.D., Australia ; Rev. J. M. P. Otts, D.D., LL.D., United States ; Rev. J. M. H. du Pontet de la Harpe, M.A., B.D., London ; Martyn J. Smith, Esq., Worcester ; C. A. Sherring, Esq., B.C.S., India ; L. W. Thrupp, Esq., B.A., London ; Rev. H. M. Walter, M.A., Oxon, Berks ; Rev. R. H. Weakley, Egypt ; Rev. H. F. Wright, M.A., Oxon, India ; Rev. T. Wood, F.E.S., Herts.

The following Paper was then read by the Rev. R. F. McLeod, in the Author's unavoidable absence :—

PRINCIPLES OF RANK AMONG ANIMALS. By Professor HENRY WEBSTER PARKER, United States.

A SYNOPSIS of recognised principles of rank in the animal kingdom is a desideratum. No separate head is made of these principles as applied to organs, *e.g.*, those of locomotion, reproduction, circulation, etc., with one exception—brain, for reasons connected with the last two heads. The outline here given is made to bear incidentally on man's position in nature, but without reference to his physical origin.

1. A rise above vegetal characters is a rise in grade. Plants have a general plan of structure, similar parts radiating from an axis. Several grand divisions of the animal kingdom would conform to this plan ; and some of the organisms are plant-like in appearance, in budding, and otherwise. Moreover, plants have digestion, circulation, respiration, and reproduction ; hence these functions (which, indeed, are all that some animals seem to possess, besides

sensation) are known as vegetal, and are so recognised even in popular language, as when we say that a person of inactive mind "simply vegetates." But the same might be said of every animal below man, because its distinctively animal endowments, nerve and muscle (or their equivalents), are subordinated to nutrition and reproduction, whereas in completely developed man all functions are subordinated to mind. Thus he stands alone.

2. Fundamental plan, in animals above radiate structure, is a criterion of rank chiefly as it has to do with the presence or absence of an internal skeleton. The nervous system will be referred to later. Vertebrates are, as a branch, superior to invertebrates in the profound modification of the whole structure and its powers by an endoskeleton. For this reason the splendid wing of a *Morpho* butterfly falls below the fin-like wing of a penguin. In respect to man, in him alone the vertebrate plan rises to its high ideal—the spinal column indeed a column, lifting his large brain and liberating and supporting the fore limbs for all the uses of that brain. Thus he stands high and apart.

3. Type may be mentioned next, not in the above sense of plan, but as referring to forms that embody the most characteristic features of their group, whether or not they are more highly endowed in every point. Not the raptorial dragonfly, nor Hercules beetle, nor the sylph-like butterfly, but the bee and ant lead their sub-order, because they best realise its ideal, namely, in compactness, mouth-parts, activity, remarkable instincts, and other points. Teliosts are inferior to sharks and ganoids in some respects, but are the most fishy of fish. The singing birds are now placed first in their class because they are the ideal birds, though not the most splendid, nor so kingly as the raptores that once usurped their place.

Of departures from type, something will be said under another head. A remark comes in here that, if man be claimed as the typical "primate" in a group with anthropoids, their departure from his ideal type sets him apart more than any identity of parts can bring him near in kind. That their so-called families, including lemurs, have as great or even greater visible differences among themselves does not bridge the chasm between him and the gorilla and chimpanzee, on this zoological principle of rank. They, too, are a type, and of something very different from him. Ordinal values are not always equal, nor the same in every class, but it may

be noted that among birds the order Gallatores, for example, is of a pronounced type, but depends on nakedness of leg and proportion of parts; "it does not appear susceptible," says the leading American ornithologist (Dr. Coues), "of further, or any very exact definition." Indeed, he speaks of the great primary division of birds into Aerial, Terrestrial, and Aquatic, as "a broad generalization upon the sum total of all the exhibitions that recent birds make in their modes of life"; the three sub-classes are "insusceptible of definition by characters of more than the slightest morphological importance." Why, then, the effort to abolish the classificatory gulf between man and the apes, unless it be a fashion and preconception that will not take all the facts and principles into view? He may even agree with them "bone for bone and muscle for muscle," but his plan of life, use of organs, and ideal of type, are as diverse as a thrush from an auk, to say the least. It does not hinder, but rather helps the argument, that savages live a brute life. The naturalist must take the best representatives of a species and as they are, howsoever they reached their degree of physical or other perfection. Origin is a matter aside, and no theory of it, unless it be weak, requires a confusion of distinctions. It may be added, incidentally, that the *ideal*, as in typical bird, fish or insect, is recognized in classification just as much as thirty or a hundred years ago.

4. Variety and development of tissues and organs are plainly among the prime criteria of rank. Differentiation is a great law of progress,—with the qualification here that, if the total individual, man or honey-bee, is specialized for the sake of the community, "the individual withers and the world is more and more." As it concerns man's place in nature, his great mass of brain is measurable, and his delicacy of feature and hand, adapted to human functions, is observable. There has been an effort to refer his superiority almost wholly to the acquirement of articulate speech. But, taking natural science on its own ground, there must be in the organic as in the inorganic a vast amount of structure beyond the reach of microscope; and, taking materialism on its own ground, there must be some great differences of occult organization to account for non-attainment by the anthropoids of that mighty instrument of progress, language proper, and the rationality it implies. The crypto-anatomy, if matter be all, must have peculiarities of more importance than likeness in the gross or the micro-anatomy. If matter

be all, of course the difference is all *there*, in matter, though it be beyond discovery.

5. Opposed to variety, should be mentioned in particular a degrading repetition of like parts of structure. Bilateral symmetry is not included here, for it has its own utilitarian and æsthetic reasons; nor is such specialization included as the number of mammalian digits. The radiate arrangement in plants and the lower animals has been noticed. In the higher organisms the centipedes are low land-arthropods; fish, with very many vertebræ and digits, among vertebrates; serpents, for similar reason, among reptiles. The principle is familiar as illustrated in repetitious rhetoric, and in the superiority of free styles of architecture over those with a formal multiplication of like parts. The principle has a limited but important application to man in his relation to creatures physically nearest him; namely, the old distinction between bimanous and quadrumanous, which no new classification can efface. Here, however, it is not so much a matter of elemental structure as of a great range of function in the human hand, and also of plan of life, which in man is non-arboreal.

6. A special point may be made of prolonged repetitious structure posteriorly. A dragon-fly, with its gauzy wings, swift flight, and falcon habits, would seem more noble than a beetle, but its lengthened abdominal segments and other reasons reduce it to near the foot of its sub-class. As the principle bears on man's zoological place, it may be noticed that, as a group, the quadrumana are tailed, long-tailed; and if the highest have essentially the human coccyx, it is equally true that some of the lower monkeys have other striking, though no more important, correspondencies to man, *e.g.*, in the special arrangement and length of hair on crown, jaw, and chin. There are all degrees of caudal development, distributed variously from the human embryo down throughout vertebrates, including the adult frog in which the tail wholly disappears; so that the phrase "tailless anthropoid" may express a literal, but is not a logical conclusion.

7. A connected criterion of importance is James D. Dana's, termed by him cephalization; it is head domination in the animal structure. Species rise in grade as the anterior part of the body is relatively more developed; the head is more compacted, the jaws less projecting; there is, it may be, an elevation of the forward extremity: and the fore limbs render more service to the head. Professor Dana illustrates the last

point by the greater numerical proportion of limbs set off from head-service to locomotion, from man down to crustaceans. In the same way there is a descent of grade from the vertical face of man, first by a leap to the prognathous anthropoids, then through the typical short-jawed carnivores and the long-jawed herbivores, reaching an extreme in whales and the hairy ant-eaters. It is obvious that man stands alone in perfect cephalization.

8. Rank has a relation to food. The limbs of the true flesh-eaters must assist the jaws in securing and holding prey, notably in the typical feline family. Further, the nervous system and active muscles must be more developed, for the capture of prey. Moreover, animal food is more stimulating, more concentrated; there is none of the constant low work of feeding on vegetation, nor a corresponding predominance of the digestive system and work, consumptive of energy. Fruits, except the pulpy, are also concentrated food, but in a less degree. The quadrumana are frugivorous, and they use their fore-hands in eating; but so do squirrels, more deftly, and sitting erect. Man as omnivorous, is quite apart from the creatures next below him. At first glance he might seem to sink to a parallelism with omnivorous rats and swine; but he rises above all in the scale, not only as the "cooking animal," but as one with a sovereign mind to intellectualize all flavours and savours, while his body royally appropriates all edible good.

9. Comparative hugeness of size, an accompaniment usually of huge eating, has been remarked as a sign of low grade, with more or less exception; it is rather a frequent concomitant than strictly a criterion. The Paradoxical frog of South America in its larval stage is five times the size of the adult; and some marked decrease is not uncommon in passing from the lower larval condition. The enormous monsters of the prime were not high in the scale; and the bulkiest creature of the deep, now, is a degraded mammal. The giants of tradition were gross. Even the huge crystal is coarse and impure. In art the Herculean human figure is represented with no great cephalic development. Man's compactness and delicacy of organization agree with his mental supremacy, and remove him far from that ogre of big bony ridges and all-crushing muscle, the highest ape.

10. Rate of growth comes in here, both prenatal and postnatal, and as connected with the amount of parental skill and care required. Ill weeds grow apace; solid wood

is long in maturing; and choice fruits and flowers demand patient culture. The noblest animals are born the most helpless, and are long in developing, for they have much to develop. Further, the parental instinct correlated with this dependent condition implies some superiority in the species. Lacépède devised a curious scale of eight ranks for birds: first, those that build no nests; next, those that build rudely; and so on until, finally, those that form a community-roof. Charles Lucien Bonaparte divided birds into two series—Altrices, that feed their young; and Præcoces, that feed themselves from the first. Man, as compared with even the creatures nearest to him, certainly is unique in long postnatal development, physical and mental.

11. A principle of great importance is drawn from metamorphosis in general and embryology in particular, namely, that what is a transition stage in one organism is the last and permanent one in another, which, not progressing, is ranked lower. The fact is found in various branches and classes, and, among batrachians, is familiar to all. Incidentally here, it is enough to say that the metamorphosis of the higher anthropoids is well known to be from a more human-like conformation in the young to less in the adult. Yet the adult, considered in the light of marked type, is not a retrograde form, but the ideal caricature (in the gorilla the utmost exaggeration of the horribly brutal) to which the simians tend. The adult properly represents the species, which is thus the very antithesis of man, who tends to the precisely opposite pole—the symmetrical, the admirable, the intellectual, the godlike. All things considered, the term “anthropoid” is, even on zoological principles, a crudeness and a jest.

12. Retrograde metamorphosis proper, along with any degeneration, strikingly illustrated in the life-history of barnacles and the worm-like entomostracans, mostly accompanies a parasitic or sedentary condition of the adult. Among men, it seems to have followed unfavourable conditions, or else some unknown process of variation. The difference between the comparatively brutal features of some degenerate human races and the noble beauty of other races, especially as embodied in the more perfect individuals, only goes to show how high is the ideal physical man above whatever is beastly.

13. Inferior features of structure are sometimes present in animals of otherwise superior grade, and so depreciate rank;

and *vice versâ*. The great kangaroo distances in speed a greyhound, but in its brain, larynx, sacrum, etc., partakes of the reptilian. The inferior character may be admirable in itself; biconcave vertebræ have their advantage, but are characteristic of fish, and therefore are a low mark in some batrachians and reptiles, and a cretaceous bird. On the other hand a patrician element may exalt a plebeian animal, as notably, the bill and eyes of a cuttle-fish. The teeth of the hoofed Anoplotheria were in some respects nearer to the human than those of the higher apes, but man is no less apart from all.

14. Intermediate, mixed, and generalized organisms may be here grouped under one head of remark, not referring, as in the preceding paragraph, to pronounced types with one or more seemingly borrowed features. They rank high or low according as they approximate to a class (or order) above or below that which is on the whole their own—the extinct reptilian birds being an obvious example of low grade. The term “generalized type” should be confined to forms that, without any very specialized features (as regarded in the light of now existing animals) were or are as if *fusions* of characters now more developed and distinctly separated; such, for example, were the first herbivores, and such now, on a low plane, the worms; as but little specialized they stand below their more distinguished kindred. Man, as alone specialized to the highest conceivable ends, is not of the same order with simians, nor, in this light, of the same kingdom except as its king.

15. The absence or abortion of an element of structure belonging to a group is, with exceptions, a sign of inferiority—exceptions such as the reduced number of digits for advanced function, *e.g.*, speed in the horse. Whales are low-caste mammals, not only as fish-like, but as lacking some normal parts of their class—less lacking in seals. Aquatic mammals have been classed by some as Mutilates, as if mutilated.* In respect to man this principle has no application, so far as it concerns internal structure. But, there is the important absence of a superficial feature com-

* Aquatic plants are generally inferior to those of the land, not needing rigid supporting tissues, nor conditioned for floral display. So in respect to aquatic animals, the buoyancy of water and the ready ingulging of swimming prey or floating food, render unnecessary a high organization for locomotion and prehension.

mon to mammals (with partial exceptions), namely, a protective covering of hair, which is even a part of the general definition of the class. As this absence is related to man's proper life, both as an inventive being and as one susceptible of a noble shame,—related also to his distinctive beauty,—it becomes a sign of superiority that removes him far from other animals.

16. Brain has its place among other organs in estimating grade, increasing in size and the cerebrum becoming relatively larger, from fish upward. Size and complexity of the brain are now regarded as having relation to all the activities of its possessor, physical as well as mental; so that any half-way approximation of the simian to the human brain in the size and convolutions is not necessarily an approximation either in amount or kind of intelligence. The vast difference is admitted. For the rest, among invertebrates, the supracæphal ganglion is but one among others apparently similar, until, in the ascending scale, it is modified in direct visible relation to organs of special sense.

17. Instinct hardly comes into zoological rank, except it be in the case of the higher insects. Its striking manifestations are distributed with little reference to structural grade, and therefore, it may be added, with as little relation to any capacity for "experience." There is good reason to subscribe to Herbert Spencer's view, that instincts fall among reflex processes; and this, notwithstanding that its results often far surpass the ordinary ones of reason proper in man, which is quite another process from anything demonstrable in animals below him, as proved both by experiment and philosophy. The attempts of late years to confuse all well established distinctions on this subject, by resolving something into nothing of its own definable-kind are among the curiosities of literature. It is just as true as ever that man stands alone as rational, however many instincts may be attributed to him, and however many of his acts are on the animal plane of sense association and its connected automatic impulses.

18. Mind is as truly an attribute of animals as flesh and bone,—at least in all that have a brain proper there is an animal mind; but it is remarkable that it has never come into classification, except in respect to man; and now it is not considered "zoological" to take it into account even in his case. There are good reasons that may justify the general exclusion; namely, below man it is a distinctively animal mind, animal "intelligence," so termed, or even

animal "reason," if it is well to use that word in two very different senses; and, though differing in degrees according to animal conditions and amount of various endowments, it is really the same in all,—quite other than reason proper with its implied abstractions and generalizations in every man. Moreover, it is difficult, if not impossible to substantiate even a general rise in this kind of "intelligence" in the animal scale upward (though this is loosely asserted), for quite as remarkable instances of animal "reasoning" are given in one grade or group as another, and among the lowest. Besides, it is difficult, if not impossible to separate an instance, a fact of this kind, from our anthropomorphic interpretation of it, and still more difficult, if not impossible, as the writer has shown elsewhere,* to separate such assumed reasoning from the certainly predominating, pervading and diversified instincts, and from sense associations with their impulses, which may be mistaken often for reasoning in man himself, and no less often in domestic animals possessing them as both original and in some way abundantly acquired. One thing is certain that no better instances of mind are observed in quadrumana than in dogs and elephants; and thus man is removed as far from his nearest zoological neighbours as from the more remote. The invisible gulf is right at his side in museum arrangement. It is a museum matter to locate him by his skeleton only. It is neither logical nor zoological to put him among the group of "Primates" as now formed, but rather to acknowledge his unique position as shown by every principle of rank in zoological classification.

It hardly need be said that no one principle or character determines an animal's place, or that of a group; all must be taken into account so far as applicable. And this, too, enforces our lesson. Man must be taken for all that he is, in all his characters and relations.

In concluding, it needs to be emphasized that there should be a marked distinction between the anatomical and the zoological classification of man. Books and papers on zoology do not fail to take into their scope the various phenomena of animal life; only when they come to classify man do they exclude everything but his anatomy. Birds and bees have been mentioned. The six pairs of minute muscles in the syrinx of singing birds (in place of these as

* *Spirit of Beauty*, 12mo., New York, 1888.

diminished or massed in Clamatores, or reduced to fewer pairs in lower groups) would not be thought of as entitling their possessors to the first place but for the power of song connected with the more complicated apparatus. The social instincts of the Hymenoptera are among the characters that determine grade. Certainly, the naturalist who is strictly naturalistic should look upon all developments of man as having weight in a natural system—human architecture as no less to be considered than honey-comb, human music no less than avian, human society no less than that of an ant-hill; he should place man apart according to the totality of his peculiar manifestations. The strained likeness to the ape's habits is shown in trying to make something of the brute's bed, sleeping position, and use of sticks and stones; how lucky it would have been if monkey or ape had made such constructive use of material as the tailor-bird, the bower-bird, the turret-building species of tarantula, or the case-building caddis worm! The materialist, *a fortiori*, cannot consistently shut out the human mind and its developments, since in his view these are animal wholly.

Concerning man, this paper has said nothing of soul, of spirit. Yet even here the tables may be turned. Aside from any idea of spiritual substance or immortal essence, the spiritual, as a writer has explained, is the moral, in all its height and breadth. If, then, there are in animals the germs of everything human, as now claimed apparently half in earnest and half in jest,—if monkeys have an "indefinite morality," and dogs a religion, and a scientific book can query whether ants are "moral and accountable,"—why, in considering man's place in nature, exclude his crowning glory as the only creature with full-orbed moral perception and responsibility, as far from apes as from dogs or even ants. The truth is that in everything except the "Primate" classification, the new science takes into account every slightest thing that is, and a vast deal that has no existence.

Man, it has been well said, begins a new series. He stands alone, erect, godlike, not so much in the pyramid of life as on its summit. And as every lofty summit of earth is overhung by shining clouds, as if the soul of the hills had risen high above, so to the vision of reasonable faith there is another series of life, the spiritual, the glorified, of which man is the beginning.

The CHAIRMAN (Professor E. HULL, LL.D., F.R.S.)—I am sure you will all wish to accord a vote of thanks to the Author of this Paper (applause) and to its reader (hear, hear).

Captain F. PETRIE, F.G.S., the Hon. Secretary.—We had hoped for the presence of the United States Minister Plenipotentiary* this evening, but a letter of regret just received from the Legation announces his departure for America. With regard to the Paper just read, a letter mentions that “Professor James D. Dana, LL.D., F.R.S., has signified his approval of the Author’s description of his views, and in other respects, and on zoological grounds, he considers man ‘the only primate;’”—a statement reminding one of the opinion given by Professor Virchow in a late Address (Volume xxiv, p. 262 of the Institute’s Journal), in which, speaking of the question as to whether it was possible for the most degraded savages to have descended from apes, he says: “No one can answer with an absolute *No*. Why should it not be possible? But from possibility to reality there is a very long step; even all else that constitutes an ape. For it is not merely the process of the temporal bone, the catarrhine nose, and the prognathic jaw, that make an ape, but many other characteristics are necessary to constitute him. *First of all we can demonstrate an ape from every strip of hide*: No anatomist, I suppose, has ever doubted the fact. Indeed, the distinctions between Man and Ape reach so far, that almost every fragment suffices for a diagnosis.” It will be remembered that Professor Virchow long ago mentioned that the further his investigations went the greater seemed the gulf between Man and Ape.†

Some important communications have been received in regard to Professor Parker’s valued Paper.

The Rev. Professor DUNS, D.D., F.R.S.E., New College, Edinburgh, writes:—

“I have read and re-read Professor Parker’s Paper, ‘Principles of Rank among Animals.’ The subject is one of much interest both from the Natural Science and the Natural Theology points of

* Now an Ambassador.

† His arguments at the “Moscow Anthropological Congress,” 1892, were to the same effect.—ED.

view. There is order in Nature. Scientific classification is the expression of this. It is not a mere arbitrary help to memory. It is, as Agassiz puts it, God's thoughts rendered into human language. Thus the basis and the function of plant and animal classification. 'There are gradations of likeness in animal structures.' The systematist does not determine these, he only interprets them, and his interpretation is the discovery to others of order in the gradation. He deals with both elements of structure and form (*κατασκευή και μορφή*), but rather with structure than with form and functions. The structural marks of gradation suggest community of organization among widely separated forms. Here the question of grade arises. What warrants it? What determines it? Is it complexity of type or concentration of type? Is it complexity of structure and organs or concentration of structure and organs? And, withal, what place is to be assigned to psychical qualities in the gradations of likeness and structure? These are vital questions. They are dealt with by Spencer in his *Data of Biology*, under the heads,—Vitality of Organisms, Environments of Organisms, and Individuality of Organisms. Corresponding aspects of thought lead to the discussion of the subject of Professor Parker's paper. He holds that 'A synopsis of recognized principles of rank in the animal kingdom is a desideratum.' It seems to me that the desideratum is to be supplied by collating the schemes of systematists rather than by the method followed by the Author. There are abundant materials at hand for this purpose in the schemes of Aristotle, Linnæus, Lamarck, Cuvier, Oken, Owen and Quaterfages. The summary of these in the work of Agassiz on 'Classification,' taken along with Huxley's 'Introduction,' brings the materials within reach for the deductions sought for in this Paper. I feel, however, that it would not be fair to say more by way of criticism, because justice could not be done to the Paper without a discussion which would occupy more space than the Paper itself."

The Rev. G. F. WHIDBORNE, M.A., F.G.S., writes:—

"It seems to me that in questions of rank in animals we ought to argue from the general to the particular rather than from the particular to the general.

Each animal fills its exact niche in nature and from that takes its actual rank. To discover or rightly to estimate this, it may be needful to consider its separate elements, and their consideration

may often correct false impressions or mistakes; but the animal really depends for its rank on its intrinsic position in nature, and not on the summation of different zoological characters. Thus, in actual fact, man's place in nature is altogether apart, and on a higher level from that of all other beings. This is our real axiom. To explain it, or measure it, we may then proceed to take into consideration his different characters in comparison with those of other animals; but these are in themselves explanatory, not dominant. Some individual characters may approximate, but because they do, we have no right to argue that the animals themselves are equally approximate in rank, or necessarily approximate at all. Even if we found that the sum of all acknowledged characters were approximate in any two animals, we should not have proved that those animals as animals were necessarily close in rank, unless we had confirmatory evidence that they were so *per se*; for some characters might have escaped observation, which would have made all the difference. This point may be abundantly illustrated from the comparative zoology of the lower animals, and still more so from palæontology, where species have constantly to be decided from very imperfect data. May I take an instance from the Brachiopoda, which I have been recently studying. Palæozoic *Atrypas* and *Rhynchonellas* have frequently been classed together, because the sums of their external characters are almost exactly the same; but when their internal characters are discovered a wide difference is at once discernible. So again some fossils of the genera *Terebratula*, *Glassia*, *Centronella*, and *Athyris* while totally differing in internal structure, are externally so similar that they have been apparently all accounted a single species, that is, of one rank, before their interiors were discovered. That is to say, the summation of all known characters in two animals may be the same, and yet their real rank be very different. We may now apply these principles to the animals. We see some which are closely approximate in all acknowledged zoological characters, but which are yet in themselves of very different rank in the true order of nature. Why is this? Because other sets of characters must have escaped our summation. That is to say, there is a vacancy for other characters besides those of ordinary zoological calculation in deciding an animal's rank. Thus, turning to the difference between the rank of man, and of the anthropoids, we find it actually very far greater than can be accounted for by mere zoological characters. Hence there is a vacancy for an 'unknown

quantity' from a zoological point of view; there must exist another set of important characters which have not been taken into account. In short 'actual rank' in nature is not necessarily synonymous with 'zoological rank.' They can only be harmonized by giving due systematic value to such characters as reason, mind, soul, and above all spirit."

Mr. H. F. KIRBY (F.L.S.).—I am sorry to say that I have not had much time to consider the Paper beforehand, dealing as it does with a large subject. Still I may say that I find that many naturalists of the most opposite schools of thought agree in considering that man ought to form a separate kingdom by himself. On the other hand I think that the Author of the interesting Paper we have had to-night should not include social insects in his account at all, because they stand entirely apart from man in the conditions of their lives and deserve to be treated independently. I see nothing unreasonable in the idea that there may be several totally different classes of reasoning beings in the same world, separated in the same manner as we are from domesticated bees. In the case of ants I very much doubt whether animals much larger in proportion as we are removed from ants would judge of our proceedings as being any more rational than those of ants appear to us, in addition to which it is believed that ants have an extension of the sense of sight, at all events, which no other higher animal possesses. Sir John Lubbock considers the range of their sight, by analysis of the spectrum, as quite equivalent to ours, and they can see further than we can on the violet side. Whether that has to do with the simple eyes or *ocelli* which ants and many other insects possess I do not know; but it is stated that the rudiments of these *ocelli* exist in some animals, notably in some lizards, and apparently in some of the fossil vertebrates they were more highly developed. It may be that the chemical action of the sun was greater than at present, and therefore there was more visible chemical action to be taken into account.

Dr. H. W. HUBBARD.—The subject is one that I have not considered much, but there is one point that I might allude to in which man stands apart from all other organisms, namely, in his articulate speech. It has been somewhat recently discovered, and is now very clearly marked out by all naturalists and philosophers, that in the human brain there is a space that is

allotted particularly to speech* which does not occur in any other organized brain whatever ; but the human brain is now clearly and definitely marked out, and that portion of which speech is its particular function.

The CHAIRMAN.—Not having any claim whatever to be considered an authority upon zoological matters you will not expect me to say very much on this question. We are glad to have had the views of an American naturalist on what we may call the great question of the day. We have an abundance of literature and of scientific views enunciated from time to time of what you may call the two schools—one, tending to demonstrate that man is nothing but a very superior kind of ape—the other, that he is closely connected with God. We recollect in the celebrated debate in Parliament, what Lord Beaconsfield said on that subject, “As for me, I am on the side of the angels.” (!) Well, I daresay most of us prefer to be ranked in that position ourselves. The Author, however, has shown what we are all pretty well familiar with—that there is a vast gulf between ourselves and the apes, or any other order or genus in the whole range of animated creation ; and, I think he has brought out one or two points with special vividness from his own point of view. He goes, in fact, very much beyond what most naturalists will in the present state of the subject, though Mr. Kirby has informed us that the view is held that man is not only a distinct order, but that he belongs to a distinct kingdom. Did I understand Mr. Kirby to say that ?

Mr. KIRBY.—Yes ; among others I believe it is held by Professor St. George Mivart, and was also held by the late Mr. J. W. Jackson—men at the opposite poles of opinion !

The CHAIRMAN.—It is very satisfactory to have men of such opposite views agree on that point. Of course the question will depend on what this individuality is—this special feature. The differences between mind and instinct and structure undoubtedly go a very long way, and, as the Author of the Paper has pointed out, the quadrumanous and bimanous are very distinct in their structure and their necessary mode of progression, and the uses to which the fore limbs are applied ; but, after all, it is the brain, as

* See Sir F. Bateman's *Recent Researches in Language*, *Transactions of the Victoria Institute*, Vol. vii.—ED.

representing the organ of thought, and speech, as the outcome of the characteristics of the brain, that will have the greatest weight with reasoning creatures as ourselves. On that point none of us can have any doubt.

Whatever be the amount of sagacity—of marvellous instinct as we call it—exhibited by animals other than ourselves, we all know that it is limited in its amount or development. The birds that sing so sweetly to-day sang equally well 50,000 years ago, if they were then existing. The beaver constructs habitations which dam up the rivers, and its ancestors did the same many thousand years ago; but it has not yet done anything more; and the ape, no doubt, in the forests of Africa lives exactly as its ancestors did also many thousand years ago. In fact, all the powers of these animals are limited and incapable of development. But with man, his mental powers, that are capable of almost unlimited development, as far as the elements of nature or his environments permit, enable him to assume a position in nature which is infinitely superior to that of any other created being.

I am not prepared to go into this subject further to-night, but I must repeat that we are all indebted to the Author for his Paper.

The Meeting was then adjourned.

REMARKS ON THE FOREGOING PAPER.

Dr. W. BODKIN writes:—

I think the paper shows that man stands at the top of the animal kingdom, not because he has better sight, hearing, taste, smell, or feeling, nor yet from his power of running, but because he has fairly good averages of all these powers; and that the part where he does excel all the animal kingdom is the rational part. The reasoning power together with imagination has enabled man not only to compare things and draw conclusions as to likeness and difference, and make fresh combinations or inventions, but he is also possessed of the hand to carry out these inventions. Man has added to his eye power by the microscope and telescope, so that no other animal can at all approach him in seeing power. So again with the power of hearing, the telephone and phonograph enable man to out-distance all competitors. Then again, though man is not equal in the sense of smell to many animals, yet by his knowledge of chemistry he detects the presence or absence, of ozone,

carbonic acid, ammonia, and microbes in the air. It would seem that man armed with these instruments of precision, is likely to somewhat neglect the proper use of his organs, so that the civilized man is thought to be behind the savage in the acuteness of his sense organs.

The fact that man stands at the top of the animal pyramid I think no one will dispute.

MR. J. W. SLATER, F.C.S., F.E.S., writes:—

The little time at my disposal does not permit me to enter upon a thorough critique of the difficult subject taken up by Professor Parker. I am very glad that the Author does not adopt the view of Professor Minot, who considers an animal the higher, the more widely its skull departs from the embryonic form. Were he to follow out consistently this principle he would assign the highest rank among the mammalia to the ant-eaters.

The Author of the Paper before us lays down certain principles for estimating the relative rank of an animal. These principles it must be admitted are clearly expressed, and are, in the main, trustworthy. But he does not clear the way by a preliminary explanation whether he would arrange the animal world on a single ascending line, or on a number of ramifications like the branches of a tree. The former plan, now generally abandoned, is fallaciously easy.

Professor Parker says, "That their so-called families, including lemurs, have as great or even greater visible differences among themselves does not bridge the chasm between him and the gorilla and chimpanzee on this zoological principle of rank." On this point differences of opinion exist.

Sec. 5. It is hard to see how the old Cuvierian distinction between "bimana" and "quadrumana" can be maintained. The hind extremities of the gorilla, etc., have heel-bones as decided as our own, and the man who can talk of a hand with a heel-bone seems to be playing with the intelligence of his hearers.

Sec. 7. The predominance of the head in an animal structure spoken of here as "James D. Dana's criterion," was, I believe, first noticed by Professor Carus, and is in full contradiction to the error of Minot.

The remark, however, that squirrels use their fore-hand in eating *more dextrously* than do monkeys must surprise anyone who has seen a monkey tie knots, or unscrew and screw the handle of a brush!

Sec. 10. How can it well be said that "Man, as compared with even the creatures nearest to him, certainly is unique in long post-natal development, physical and mental." On referring to Dr. A. R. Wallace's *Eastern Archipelago* we shall find an account of the babyhood of a Mias, which shows a striking parallelism with the infancy of our own species.

The fact that an infant gorilla is very like a human child, but that the resemblance fades as both approach maturity is a most instructive fact, and admits of being generalized, proving that the animal series is not linear. The embryonic dog (not to speak of the apes) is vastly more like the earlier pre-natal stages of man than are the mature individuals. We may even remark that up to the age of adolescence the negro, the Australian black fellow, etc., seem quite equal to our own race, but afterwards fall more and more into the background.

We shall, perhaps, best understand the position of man with relation to the anthropoids if we consider him as the head of a distinct ascending series.

THE AUTHOR'S REPLY.

The discussion has interested me much. I am aware that I left abundant room for the additional suggestions, for I had confined myself most strictly to the topic announced, and condensed all to the utmost—not touching, for example, on the many past or present schemes of classification, genealogical or other, except in some reference to man's place in any scheme—and man was not brought into the paper until its close—in fact, it was the intellectual interest of the principles themselves that first prompted the essay, not a desire to seek and expound practical rules (which are not to be confounded with general principles) for tabulating the animal kingdom; indeed, this is not a matter of mere rules, but of the complete study of organisms.

Mr. Slater's valuable remarks are of the nature of *corrigenda*. In reply I would say that a linear arrangement of all animals is too obsolete to need disavowal, especially in a paper that deals with principles only, not tabulations. In regard to the word "quadrumana," it may be granted that it is not the best in the light of Anatomy; it remains as true as ever that the extremities of all the simian limbs are hand-like. As to squirrels, I grant that instead of the words "more deftly," it would have been clearer and more correct to say "as deftly in manipulating food." The last criticism by Mr. Slater seems to overlook the complete phrase used—"physical and mental"; also the long development of man, his mental development, under favourable circumstances, extending to old age.

NOTE ON THE RECESSION OF NIAGARA FALLS.

The question of the rate of the recession of the Falls of Niagara has been the subject of much inquiry, since Lyell estimated that "the cutting of the present gorge terminating at the heights towards Lake Ontario had taken 35,000 years."

Volume xix of the Victoria Institute's Transactions (p. 90) contains a summary of the Report of the New York Commission, and diagrams therefrom; from this Report it had been estimated that the cutting had taken only 10,000 years.—Through the kindness of one of the Institute's Members, Mr. Warren Upham, the Assistant U.S. Government Geologist, the following particulars are given as to where the results of most other surveys are recorded.

"The early report, by Prof. James Hall, in 1842, is in *The Natural History of New York, Geology*, Part IV, pp. 402-403.

"In 1875 a second survey was made by the United States Army Engineers.

"The next survey was made in 1886 by Mr. R. S. Woodward, of the United States Geological Survey, and his work was published in New York in *Science*, vol. viii, p. 205.

"Still more recent surveys have been made,* of which a more important one is summarised in *Science*, vol. xviii, p. 216, 1891.

"Mr. John Bogart, State Engineer of New York, has sent in a report concerning the recession of Niagara Falls. In 1842 Professor James Hall made an accurate survey, and a comparison of his results with those in 1890, made in a bulletin of the American Geographical Society, shows that the annual recession at the American Fall has been 7.68 inches, and at the Canadian or Horseshoe Fall, 2 feet 2.16 inches. During this period the crest line of the American Fall has sunk from 1,080 to 1,060 feet, and that of the Canadian has risen from 2,260 to 3,010 feet. The area of rock which has been carried away during those forty-eight years is 32,900 square feet at the American Fall, and 275,400 square feet at the Canadian Fall.

"In 1889 Mr. G. K. Gilbert, of the United States Geological

* The reports of these may probably be obtained by addressing *The State Engineer of New York*, at Albany, N.Y., U.S.A.

Survey, Washington, D.C., discussed the 'History of Niagara River,' in a long and very valuable paper, with maps, originally published in the *Sixth Annual Report of the Commissioners of the State Reservation at Niagara for the year 1889*, pp. 61-84. This same paper is republished in one of the *Annual Reports of the Smithsonian Institution for the year 1891*. Mr. Gilbert finds the maximum rate of retreat of the apex of the Horseshoe Fall (the re-entrant angle where erosion is most rapid) to be 'between four feet and six feet per annum.' [Mr. Bogart's figure may be taken as the average for the whole line of the Horseshoe.] Arguing that 'the rate of retreat of the central portion of the Horseshoe is the rate at which the gorge grows longer,' Mr. Gilbert concludes that probably '7,000 years were needed to excavate the six miles of gorge from Queens-town Heights.' But various considerations qualify this estimate, some of these tending to shorten and others to extend it. These are discussed by him in the paper mentioned.

"See also a report of Mr. Woodward's work and discussion by Mr. Gilbert, in *Proc. Am. Assoc. Adv. of Sci.*, vol. xxxv, for 1886, pp. 222-3."
